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STATUS REPORT

Northern Forest Health Monitoring

Fiscal Year 1992

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Introduction

The twenty-State Northeastern Area (which includes the Northeastern and North Central Forest Experiment Stations) and the Eastern Region encompasses 163 million acres of forest land and 111 million people. Forest resources in this region are of tremendous value, not simply for forest products, but also for recreation, wildlife, fisheries, and aesthetics associated with the use of these forest lands. In recent years, there has been considerable attention on threats to the health of this resource posed by acidic deposition and associated pollutants, and increases in forest pest activities. The USDA Forest Service and many state forestry organizations have been asked to assess and provide information to determine if these threats are affecting the health of our forests. In response to these concerns, a National Forest Health Monitoring Program was implemented in New England in 1990 by the Northeastern Forest Experiment Station, Forest Inventory and Analysis (FIA) and the Northeastern Area State and Private Forestry, Forest Health Protection (FHP).

The term "forest health" describes forest conditions relative to values, needs, and expectations. Forest Health Monitoring is a program designed to determine whether forest conditions are likely to meet the required values, needs, and expectations, and if changes in management are necessary. An additional, and very important benefit, is providing information on existing or potential problems. The Program is designed to annually collect, analyze, and report on the conditions of all forests in the United States.

Monitoring can be defined as the repeated measurement or sampling of pertinent data for comparison to a reference system or identified baseline. It always involves the determination of changes over time, usually interpreted against a baseline. Its ultimate value comes when the information that is collected, analyzed, and interpreted is used in making management and policy decisions.

Currently, the Forest Service gathers data on the forest resource and forest pests in various ways. The two most notable activities are the periodic FIA surveys conducted on most forest lands by the two Experiment Stations and insect and pathogen surveys conducted by FHP on federal forest lands and together with state agencies on state and private forest lands. The Northern Forest Health Monitoring Program utilizes the expertise of these groups in a coordinated fashion, to collect, analyze, and report forest conditions. Forest Health Monitoring is an integral part of the Forest Service's Forest/Atmosphere Interaction Program proposed under the Forest Ecosystems and Atmospheric Pollution Research Act of 1988 (PL 100-521) and the Forest Stewardship Act of 1990 (PL 101-624) and involves coordination with the Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP).

Program Components

Detection.

Systematic data collection on all forests in the United States to detect unexpected changes in trees and forest conditions from an established baseline. The data are collected from a permanent plot network, other off-detection plot surveys, and other data sources.

This aspect of the program consists of a series of plots linked to the FIA inventory system on which periodic measurements are made relating to the functioning of a forest. The plots are selected within a system of 40 sq. km. (10,000 acres or 16 sq. mi.) hexagons, located on a triangular grid network developed by EMAP.

The detection network will be visited annually and managed by FIA and state cooperators. The measurements have been organized into indicators of forest conditions. The indicators are growth, visual symptoms of trees, soil characteristics, foliar nutrition, vegetation structure, and mortality. The measurements will be monitored to establish a baseline and to detect any changes in forest condition. In addition, analyses of spatial variability can be used to determine regional forest health conditions.

Collection of non-plot information is used to possibly explain deviations of detection plot information and establish baseline information on forest condition. The non-plot information includes insect and pathogen distribution surveys, weather and climate data, pollutant deposition information, FIA information, and fire frequency data. The forest pest condition reporting system will provide area-wide information on major insects, pathogens, fire incidence, and impacts to supplement data collected on the plot network. The weather, climate, and pollutant deposition information will be assembled and reported by the EMAP personnel.

Evaluation.

Intensive systematic monitoring designed to evaluate abnormal changes, to confirm suspected changes, and/or to determine probable causes of change identified by detection monitoring.

Evaluation monitoring will focus on specific forest types, tree species, and/or regions that have unexplained deviations from established baselines as identified by detection monitoring activities. The investigations will attempt to explain the specific cause and effect relationships between the deviations and forest stressors such as: insects, pathogens, weather, and climate data or combinations of the stressors. If specific cause and effect relationships cannot be determined, then identification of research hypotheses will be developed for ecosystem monitoring activities.

Ecosystem.

Intensive monitoring on a small number of "representative" forested ecosystems designed to focus on the understanding of mechanisms of change.

Ecosystem monitoring will focus on intensive forest ecosystem measurements to improve the understanding of ecosystem functions and cause and effect relationships. This level of Forest Health Monitoring will occur on a small number of sites that represent major forest ecosystem types.

Illustrated in Table 1 below are the detection and evaluation activities that occurred in the twenty States that comprise the Northeastern Area, State and Private Forestry in Fiscal Year (FY) 1991 and FY 1992.

Table 1. Detection and Evaluation Activities Occurring in the States, Forest Health Monitoring, FY 1991 and FY 1992.

| State | Detection FY 1991 | Evaluation FY 1991 | Detection FY 1992 | Evaluation FY 1992 |
|-------|----------------------|-----------------------|----------------------|-----------------------|
| CT | ● | | ● | |
| DE | ● | | ● | |
| IL | | | | |
| IN | | | | |
| IA | | | | |
| ME | ● | ● | ● | ● |
| MD | ● | | ● | |
| MA | ● | ● | ● | ● |
| MI | | ● | | ● |
| MN | | | | ● |
| MO | | | | |
| NH | ● | ● | ● | ● |
| NJ | ● | | ● | |
| NY | | ● | | ● |
| OH | | | | ● |
| PA | | | | ● |
| RI | ● | | ● | |
| VT | ● | ● | ● | ● |
| WV | | | | |
| WI | | ● | | ● |

Program Goals and Direction

The goal of the Forest Health Monitoring Program is to detect and report on unexpected changes in forest conditions and to coordinate an evaluation of these changes at the multi-state level. A secondary goal is to improve the efficiency and effectiveness of pest management and the land management decisionmaking processes. Northern Forest Health Monitoring is a part of the National Program.

The following activities are planned:

- Cooperate with all twenty Northeastern and Midwestern State agencies and EMAP in establishing and collecting data on detection monitoring plots.
- Develop and implement a standard collection and reporting system for forest pest (or damage)/fire conditions for the Northeastern Area's and Region 8's Forest Pest Management (FPM) with assistance from our cooperators, utilizing Geographic Information System (GIS) data base technology.
- Develop and coordinate evaluation monitoring projects with our cooperators addressing specific forest health issues.
- Produce and report information on various scales that is useful in making management and policy decisions.
- Establish funding sources and develop budget processes to assure long-term support for detection and evaluation level monitoring conducted by the Forest Service and our cooperators.

Indicated in Table 2 are Fiscal Years 1990 through 1992 funds allocated from Research and State and Private Forestry to the twenty States that comprise the Northeastern Area.

Table 2. Allocation of Federal Financial Assistance to States, Forest Health Monitoring, Fiscal Years 1990 through 1992.

| State | FY 1990 ¹ | FY 1991 | FY 1992 | Total |
|-----------------|----------------------|------------------|------------------|--------------------|
| CT | \$ 11,700 | \$ 7,500 | \$ 7,500 | \$ 15,000 |
| DE | 0 | 34,700 | 35,200 | 69,900 |
| IL | 0 | 0 | 0 | 0 |
| IN | 0 | 0 | 0 | 0 |
| IA | 0 | 0 | 0 | 0 |
| ME | 105,550 | 200,200 | 225,000 | 425,200 |
| MD | 0 | 45,600 | 39,800 | 85,400 |
| MA | 58,460 | 54,500 | 48,300 | 102,800 |
| MI | 10,000 | 16,000 | 16,000 | 32,000 |
| MN | 0 | 0 | 8,000 | 8,000 |
| MO | 0 | 0 | 0 | 0 |
| NH | 36,750 | 87,100 | 80,500 | 167,600 |
| NJ | 0 | 41,200 | 30,000 | 71,200 |
| NY | 15,000 | 15,000 | 48,000 | 63,000 |
| OH | 0 | 0 | 6,000 | 6,000 |
| PA | 0 | 0 | 8,000 | 8,000 |
| RI | 4,100 | 21,300 | 21,300 | 42,600 |
| VT | 39,250 | 113,300 | 118,500 | 231,800 |
| WV | 0 | 0 | 0 | 0 |
| WI | 15,000 | 18,000 | 18,000 | 36,000 |
| To be allocated | 0 | 0 | 9,800 | 9,800 |
| Total | \$295,810 | \$654,400 | \$719,900 | \$1,374,300 |

¹ This does not include the Federal Program.

The Northern Forest Health Monitoring Program in Fiscal Year 1991

Northern Forest Health Monitoring

During Fiscal Year 1991, seventy-eight additional plots were added to the detection plot network in Delaware, Maryland, and New Jersey. A total of 341 plots have been installed. [Note: In 1990, 263 plots were installed in the six New England States: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.] The second year of data collection was accomplished on the 263 New England plots. Plot establishment and data collection began in June 1991 and was completed by September. FHP made a significant contribution in the planning, field guide development, training of field crews, management, and interpretation of results for detection plot measurements and data. A summary of the 1990 results was published during 1991, "Summary Report: Forest Health Monitoring - New England, 1990." No unexplained forest health problems were detected in 1991. A similar report, including the additional States, will be produced in early 1992.

National Coordination and Planning

Some Forest Service personnel participated in the development and coordination of National Forest Health Monitoring with representatives from the Forest Service and EMAP National Planning Personnel. These activities consisted of weekly conference calls, meetings, and the development of planning documents to coordinate national planning and implementation. These activities will continue.

Pest Conditions in New England

In 1991, the New England States and FHP cooperated in the collection and compilation of aerial detection survey information utilizing the Geographic Information System (GIS) system at the Durham Field Office. The summary of 1990 results was published as the "Forest Health Report - New England and New York, 1990" by the Durham Field Office.

North American Sugar Maple Decline Project

Reports of sugar maple decline in the Northeastern States and adjoining Canadian Provinces triggered the initiation of this project within the National Acid Precipitation Assessment Program (NAPAP) in 1987. States, Provinces and both Federal governments cooperate and contribute to the various components of this Project. A formal international agreement between the Forest Service, Forestry Canada, seven States, and three provinces was signed in 1990. A total of 177 clusters of five plots each (approximately 15,000 trees) have been annually monitored for crown condition since 1988. With the completion of NAPAP in 1990, FHP provided financial support to continue this project. Preliminary results indicate that sugar maple conditions are generally good across the region surveyed, but localized responses to insects and drought have been identified. The field methods and project structure have been published in 1991, "North American Sugar Maple Decline Project: Organization and Field Methods." Project results for 1988 through 1989 were published in the spring of 1991, "Changes in Sugar Maple Conditions between 1988 and 1989."

Supplemental Damage Detection Plots in Delaware

In 1991, forest condition monitoring plots were established in Delaware by personnel from the Delaware Department of Agriculture. Ten plots were established in each of three forest types, oak/pine, oak/hickory, and pine, throughout the State. At each location, data is collected by tree species for crown condition, and signs or symptoms of damage. The procedures used are comparable to the detection plot procedures. The plots will be visited annually and the data will be used as a systematic statewide survey of forest condition.

Off-Detection Plot Damage Survey Standardization

FHP began a process to standardize the collection and reporting of forest pest survey information. These procedures will be finalized in conjunction with Region 8 FPM personnel to develop an eastern U.S. approach to FHP/FPM activities in support of Forest Health Monitoring. The standardization of this information will provide useful information in support of detection plot results and interpretation. In addition, the standardization of this information will provide comparable information for other FHP reporting activities. The work plan structuring these activities has been developed and is currently under review by state and Forest Service personnel in the Northeastern Area and Region 8.

Spruce-Fir Decline Project

The Spruce-Fir Decline Project was initiated in 1985 as a cooperative survey to define crown symptoms, determine trends in tree condition, and map mortality of red spruce and balsam fir in New York, Vermont, New Hampshire, Massachusetts, and West Virginia. Field data was collected from eighty sites between 1985 and 1990. A subset of plots were revisited during 1991. During 1991, data were compiled and analyzed. Initial indications are that foliage loss due to branch mortality or dieback is prevalent, particularly on high elevation sites. A color photographic field guide was published in 1991 and is titled, "Damage Agents Associated with Visual Symptoms on Red Spruce and Balsam Fir in the Northeastern United States."

Maine and Vermont Hardwood Surveys

Cooperative surveys with the Vermont Department of Forests, Parks, and Recreation, and the Maine Bureau of Forestry have been undertaken to determine the condition of hardwood forests. Vermont completed an initial survey in 1986 indicating the number and volume of dead trees was not alarming and appeared similar to that reported in past surveys. During 1990, Vermont and FHP began a resurvey of 1985 and 1986 sites to determine trends. All photo interpretation and ground checking was done in 1991.

Maine's hardwood survey was initiated in 1987 with the acquisition of aerial photography. Field data was collected during 1988 and 1989. Photo interpretation was conducted during 1990.

Vermont Videography Project

This project was organized in 1991 in cooperation with the Vermont Department of Forests, Parks, and Recreation, FHP and the FPM Methods Application Group. The objective of this project was to investigate the feasibility of using aerial video technology to assess forest conditions. This information will be compared with existing aerial sketch mapping in detecting forest health conditions. In 1991, all video imagery was collected.

The Northern Forest Health Monitoring Program in Fiscal Year 1992

In Fiscal Year 1992, the Forest Service will include the same nine States in the detection monitoring plot network and pest conditions aspect of Northern Forest Health Monitoring as in 1991.

The Northeastern Area FHP staff will coordinate the North America Sugar Maple Decline Project as evaluation monitoring and report on high elevation spruce/fir conditions. The North American Sugar Maple Decline Project will collect the fifth year of crown condition data. A few additional plots (approximately twenty) will be added in Ohio, Pennsylvania and Minnesota. A review of the project will be scheduled for summer of 1992 to determine future direction for the project.

FHP in conjunction with Region 8 FPM and state personnel, will continue the process to standardize the collection and reporting of forest pest survey information for the Eastern U.S. in support of Forest Health Monitoring. The standardization of this information will provide useful information in support of detection plot results and interpretation. In 1992, draft procedures will be tested with publication of final procedures in 1992 or early 1993. In addition, the standardization of this information will provide comparable information for other FHP reporting activities. The work plan covering all FHP/FPM activities will be finalized in 1992.

The Vermont Videography Project will analyze all imagery collected in 1991 and develop a final report on the findings.

In 1992, a similar plot network to the Delaware plot system will be established in New Jersey by the New Jersey Department of Environmental Protection. Plots in New Jersey will be established in hemlock, oak/pine, Atlantic white cedar, and oak/hickory forest types. The purpose of the forest condition plots in New Jersey is to supplement the data collected from the Forest Health Monitoring plot network. Information from the New Jersey and Delaware plot networks will be used in the annual State forest health reports.

A pest conditions database reporting system is under development to allow state cooperators an automated process to compile and report the pest conditions. The requested information will be similar to previous information on pest conditions but will include detailed geographic information on the location of the pest activity. The inclusion of this information will allow easier transfer of data to GIS systems. Also, all of the State and Northeastern Area data will be returned to the State for their own needs. The program will be tested in cooperation with Delaware Department of Agriculture personnel.

Publication of the first annual "State Forest Condition Report" for all states actively involved in Forest Health Monitoring will be produced during the spring of 1992. These reports will be developed by the States with assistance from FHP. The focus of these reports will reflect the needs of the States and include information on the state of the forest resource within the State. A comparable publication will be developed by FHP for the entire Northeastern Area.

The data analyses and reporting will be completed for the Vermont and Maine Hardwood Surveys.

A final report on the five-year results from the Spruce-Fir Decline Project will be published.

Illustrated below in Table 3 is the summary of Northern Forest Health Monitoring Implementation for Fiscal Years 1990 through 1994 in the Northeastern Area.

Table 3. Summary of Northern Forest Health Monitoring Implementation, Forest Health Monitoring, Fiscal Years 1990 through 1994, The Northeastern Area.

| Monitoring Level | Accomplishments | | | ...Targets... | |
|-------------------|-------------------------------|------|------|---------------|------|
| | 1990 | 1991 | 1992 | 1993 | 1994 |
| | <i>...Number of states...</i> | | | | |
| Detection | | | | | |
| Plot Network | 6 | 9 | 9 | 11 | 13 |
| Evaluation | | | | | |
| Projects (FHP) | | | | | |
| Sugar Maple | 7 | 7 | 10 | 10 | 10 |
| Red Spruce | 5 | 4 | 0 | 0 | 0 |
| Hardwood | 2 | 2 | 0 | 0 | 0 |

The Northern Forest Health Monitoring Program Outlook for Fiscal Years 1993 through 1994

- Continue to provide support to the Maine and Vermont Hardwood Survey, as needed.
- Plan for, and implement, Northern Forest Health Monitoring for additional States within the twenty States that comprise the Northeastern Area.
- Refine the list of standardized procedures for off-detection plot surveys.
- Continue the North American Sugar Maple Decline Project with data collection through 1993.

Budget Summary for Fiscal Years 1990 through 1994

As illustrated below, the funding history and estimates for the Northeastern Area FHP, the Northeastern and North Central Experiment Stations involvement in Northern Forest Health Monitoring for Fiscal Years 1990 through 1994.

Table 4. Funding History and Estimates, Fiscal Years 1990 through 1994, Northeastern Area, Northeastern Station, and North Central Station.

| | 1990 Final | 1991 Final | 1992 Final | 1993 Planned | 1994 Planned |
|-----------------------------------|---------------|---------------|-----------------|-----------------|-----------------|
| ...Dollars in thousands... | | | | | |
| Forest Health Protection | | | | | |
| Cooperative Forest Health Program | \$ 0 | \$ 375 | \$ 380 | \$ 500 | \$ 500 |
| Pest Conditions Database | 120 | 30 | 40 | 40 | 30 |
| Evaluation Monitoring | 30 | 100 | 176 | 190 | 190 |
| Plot Network Support | 60 | 46 | 66 | 70 | 75 |
| Personnel Resources | 45 | 70 | 190 | 200 | 205 |
| Subtotal | 255 | 621 | 852 | 1,000 | 1,000 |
| Northeastern Station | 600 | 325 | 325 | 440 | 440 |
| North Central Station | 0 | 0 | 0 | 190 | 570 |
| Subtotal | 600 | 325 | 325 | 630 | 1,010 |
| Total | \$ 855 | \$ 946 | \$ 1,177 | \$ 1,630 | \$ 2,010 |

Organization

Overall coordination will be accomplished through an Executive Steering Committee that could include the Northeastern Area Director, Northeastern Station Director, North Central Station Director, National Program Manager, an EMAP representative, a Forestry Canada representative, and three State Foresters from the Northeastern Area.

Within each of the Forest Experiment Stations, the program is administered and implemented by FIA staff. The state cooperators also provide input on the program direction and implementation. For the Northeastern Area, State & Private Forestry the program is administered from the FHP Area Office in Radnor, Pennsylvania. Program implementation is managed by FHP specialists in each of the field units located in Durham, New Hampshire; Morgantown, West Virginia; and St. Paul, Minnesota.

For additional information contact:

Northeastern Area, State and Private Forestry
5 Radnor Corporate Center, Suite 200
100 Matsonford Road, P.O. Box 6775
Radnor, PA 19087
(215) 975-4111

Northeastern Forest Experiment Station
5 Radnor Corporate Center, Suite 200
100 Matsonford Road, P.O. Box 6775
Radnor, PA 19087
(215) 975-4017

North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, MN 55108
(612) 649-5249

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